REMARKS

New claims 9-16 are similar to claims 1-8, respectively, but further recite that the controller judges that the self-ignition state has been established in the internal-combustion engine prior to the rotation speed reaching the idling rotation speed, and that the apparatus or method prevents overshoot in the rotation speed of an internal-combustion engine before reaching an idling rotation speed thereof. Support is found, for example, bridging pages 4-5 of the specification, which describes that upon judgment that self-ignition has been established, the controller switches from driving control to breaking control to thereby prevent overshoot in the rotation speed of the internal-combustion engine (new claim 9). See corresponding disclosure at page 6, lines 3-8 (new claim 10); at page 7, lines 15-20 (new claim 13); and at page 8, lines 18-23 (new claim 14). Further in this regard, overshoot in the rotation speed necessarily precedes the point at which idling rotation speed is achieved as shown, for example, in Fig. 6A of the specification. More particularly, because the rotation speed increases sharply once self-ignition has been established (page 11, lines 15-17 and Fig. 6A), and because the claimed apparatus or method is adapted for preventing overshoot in rotation speed, the judgment that self-ignition has been established is carried out prior to the rotation speed reaching the idling rotation speed.

Review and reconsideration on the merits are requested.

Claims 1-8 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,495,127 to Aota et al. The Examiner cited Aota et al as disclosing the invention substantially as claimed, including a three-phase starter-generator 3 that is controlled by switching power

control unit 5, so as to apply breaking to prevent speed overshooting (citing col. 5, line 55 to col. 6, line 38).

Applicants respectfully traverse for the following reasons.

1. **Characteristic Features of the Present Invention:**

The present invention solves the problem of overshoot in the rotation speed of an internal-combustion engine as a result of excess torque generated by a starter motor, due to mechanical delays in the air system and fuel system and delays in the control system, once the engine achieves self-ignition (pages 1-2 of the specification).

In a first aspect (present claims 1 and 5) the present invention provides an apparatus and method by which a starter/battery charger coupled to a crank shaft of the engine is switched from driving control to breaking control upon judgment that the self-ignition state has been established. In a second embodiment (present claims 2 and 6), a controller is provided for causing the starter/battery charger including 3-phase armature coils to generate positive torque and a breaking control for causing the starter/battery charger to generate negative torque, to thereby control the rotation speed of the engine. Furthermore, the controller causes the starter/battery charger to generate negative torque in the breaking control by short-circuiting between phases of the three-phase armature coils of the starter/battery charger, to thereby prevent overshoot in the rotation speed of the engine. Claims 3 and 7 depending from claims 2 and 6, respectively, define switches provided between three-phase lines of the three-phase armature coils so as to effect short-circuiting. As defined in independent claims 4 and 8, the starter-battery

charger further includes a field coil in which the controller controls current flow through the field coil to thereby prevent rapid torque variation in the starter/battery charger.

2. **Discussion of Applied Prior Art:**

Turning to the cited prior art, Aota et al discloses an engine starting apparatus which suppresses engine vibrations and noises during engine cranking. Particularly, when an engine starts to rotate to produce its torque, electric power supply to a starter motor for engine cranking is reduced gradually so that a sum of torques produced by the starter motor and the engine may be prevented from increasing excessively. Particularly, operation of a generator/motor is switched from motor operation to generator operation for suppressing excessive speed rise when engine starting is completed (Abstract).

Torque is controlled as described at col. 3, lines 26-38, by use of a switching supply to control the duty ratio of the exciting current of generator/motor 3. As described at col. 4, lines 47-57, the excitation angle of current delivered to the three-phase starter motor is advanced so as to decrease the driving torque produced in the motor operation of generator/motor 3. As claimed in claim 1 of Aota et al, the starting apparatus includes second means for instructing the control unit so that torque generated by the motor operation is gradually reduced when the rotation speed of the engine reaches a predetermined value.

3. **Claims 1-8 Not Anticipated by Aota et al:**

The invention of present claims 1 and 5 differs from Aota et al in that Aota et al fails to disclose the claimed "breaking" control. Rather, Aota et al simply advances the excitation angle so as to gradually reduce output torque, without application of breaking control as required by

present claims 1 and 5. Namely, the output torque of the generator/motor 3 is gradually reduced such that the sum of the torques of the starter motor and the engine is prevented from increasing excessively (col. 1, lines 60-64). Particularly, as described at col. 2, lines 1-5 of Aota et al:

> Though the torque from the starter motor is reduced after the rise in the rotational speed, it is continued to be applied to the engine and hence the rotational speed is not increased excessively but is increased stably to assure the engine starting without causing engine stall.
>
> That is, the apparatus and technique of Aota et al reduces the torque contribution of the generator/motor 3, but does not effect breaking control.

4. **Separate Patentability of Claims 3 and 7 and 4-8:**

Likewise, Aota et al fails to disclose a controller which causes the starter/battery charter to generator negative torque in the break control by effecting short-circuiting between phases of 3-phase armature coils of the starter/battery charger as claimed in claims 2 and 6. There is nothing in Aota et al which suggests the generation of negative torque, let alone the generation of negative torque by short-circuiting between phases of the 3-phase armature coils of the starter/battery charger. Aota et al also does not disclose switches provided between 3-phase lines of the 3-phase armature coils of the starter/battery charger for effecting short-circuiting as required by claims 3 and 7.

Aota et al describes an exciting coil 31 at col. 3, lines 7-10, but there is no disclosure of controlling current flowing through the field coil to prevent rapid torque variation as required by claims 4 and 8.

The passage at col. 5, line 55 to col. 6, line 38 of Aota et al cited by the Examiner also fails to disclose breaking control and/or generation of negative torque. Rather, as taught by Aota et al, overshooting is suppressed by switching generator/motor 3 to generator operation (col. 5,

lines 60-62 and col. 6, lines 2-5), and nothing else. As shown in Fig. 11 of Aota et al, after the engine speed reaches an idling speed of 650 rpm, and upon detection of overshooting, generator/motor 3 is switched from motor operation to generator operation - so as to reduce the torque contribution of the starter motor.

Thus, as shown above, Aota et al does not disclose each and every limitation of the rejected claims, and moreover fails to teach or suggest application of breaking control to prevent overshooting. Furthermore, Aota also fails to disclose switches provided between three-phase lines of three-phase armature coils (claims 3 and 7) or controlling current flowing through a field coil to prevent rapid torque variation (claims 4 and 8). Thus, these dependent claims are also separately patentable over Aota et al.

For the above reasons, it is respectfully submitted that claims 1-8 are not anticipated by Aota et al, and withdrawal of the foregoing rejection under 35 U.S.C. § 102(b) is respectfully requested.

Applicants further comment on patentability of new claims 9-16 as follows.

5. Patentability of New Claims 9-16:

As claimed in new independent claims 9, 10, 13 and 14, the controller judges that self-ignition has been established in the internal-combustion engine prior to the rotation speed reaching the idling rotation speed, and then switches from driving control to breaking control upon judging that self-ignition has been established prior to the rotation speed reaching the idling rotation speed.

Namely, in this manner, switching from driving control to breaking control is performed once self-ignition has been established and prior to the rotation speed reaching the idling rotation speed to thereby effectively prevent overshoot in the rotation speed of the engine.

Additional differences between the invention of new claims 9-16 and the cited prior art are as follows.

Aota et al discloses a first embodiment shown in Figs. 1-9 and 12 and a third embodiment shown in Figs. 10, 11 and 13. In the first embodiment, if the rotation speed Ne is larger than 300 rpm, the excitation angle is advanced to decrease driving torque produced in the motor operation of generator/motor 3, as described at col. 4, lines 58-62. That is, energization of generator/motor 3 is stopped to thereby stop motor operation. See col. 4, line 62. However, in this embodiment, no breaking control is performed as required by the present claims.

In the third embodiment of Aota et al, if the rotation speed Ne is larger than 650 rpm (i.e., idling speed), the generator/motor 3 is controlled to switch to generator operation alone to suppress overshooting, as described at col. 5, line 57 - col. 6, line 5. However, this embodiment detects the overshoot at idling speed (650 rpm). Because generator/motor 3 is switched to generator operation at the idling speed (650 rpm), generator operation is delayed until the engine reaches idling speed (650 rpm), and therefore overshoot cannot be effectively suppressed or prevented. In contrast, in the present invention, operation is switched from driving control to breaking control once a judgment is made that self-ignition has been established and prior to reaching the idling or rotation speed.

Withdrawal of all rejections and allowance of claims 1-16 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

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